O.B/O.D. EXCERPTS

PHASE III INSTALLATION RESTORATION PROGRAM

REMEDIAL INVESTIGATION/FEASIBILITY STUDY

DRAFT INTERIM REPORT

VOLUME 1: TECHNICAL DATA

MARCH 1992

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Naval Weapons Station Earle
Colts Neck, NJ

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The headwaters and portions of the drainage basins of three major Coastal Plain rivers, the Swimming, the Manasquan, and the Shark, are present on the Main Base (see Figure 2-1). The northern half of the Main Base is in the drainage basin of the Swimming River, and tributaries include Mine Brook, Hockhockson Brook, and Pine Brook. The southwestern portion of the Main Base drains to the Manasquan River via either Marsh Bog Brook or Mingamahone Brook. The southeastern corner of the Main Base drains to the Shark River. Both the Swimming River and the Shark River supply water to reservoirs used for public water supplies. Surface water drainage from the waterfront area enters Sandy Hook Bay. Much of this area is under tidal influence.

Most of the surface drainage from the Chapel Hill area flows north to Sandy Hook Bay via Compton, Ware, and Wagner Creeks. A very small area at the topographically high southern end of the Chapel Hill area drains south through McClees Creek to the Navesink River.

2.1.4 Soils

The soils at NWS Earle are generally distributed in northeast/southwest-trending belts that parallel the outcrop patterns of the underlying geologic units. More than half of the identified soil types in Monmouth County are found on the NWS Earle facility; the dominant soil in this area is sandy and well drained.

The soils typically have high iron and sulfur contents and many are acidic. Acidic soils form from the weathering of pyrite (sulfur ore) or lignite (low-grade coal) contained in the sedimentary deposits. When exposed to air and water these materials form corrosive sulfuric acid. Severely acid soils with pH values as low as 3.5 can be developed naturally in some of the soils found at NWS Earle.

Poorly drained soils are typically organic-rich and occur in low-lying areas such as swamps, marshes, and flood plains. These poorly drained unconsolidated sediments are prone to settlement and subject to flooding and tides.

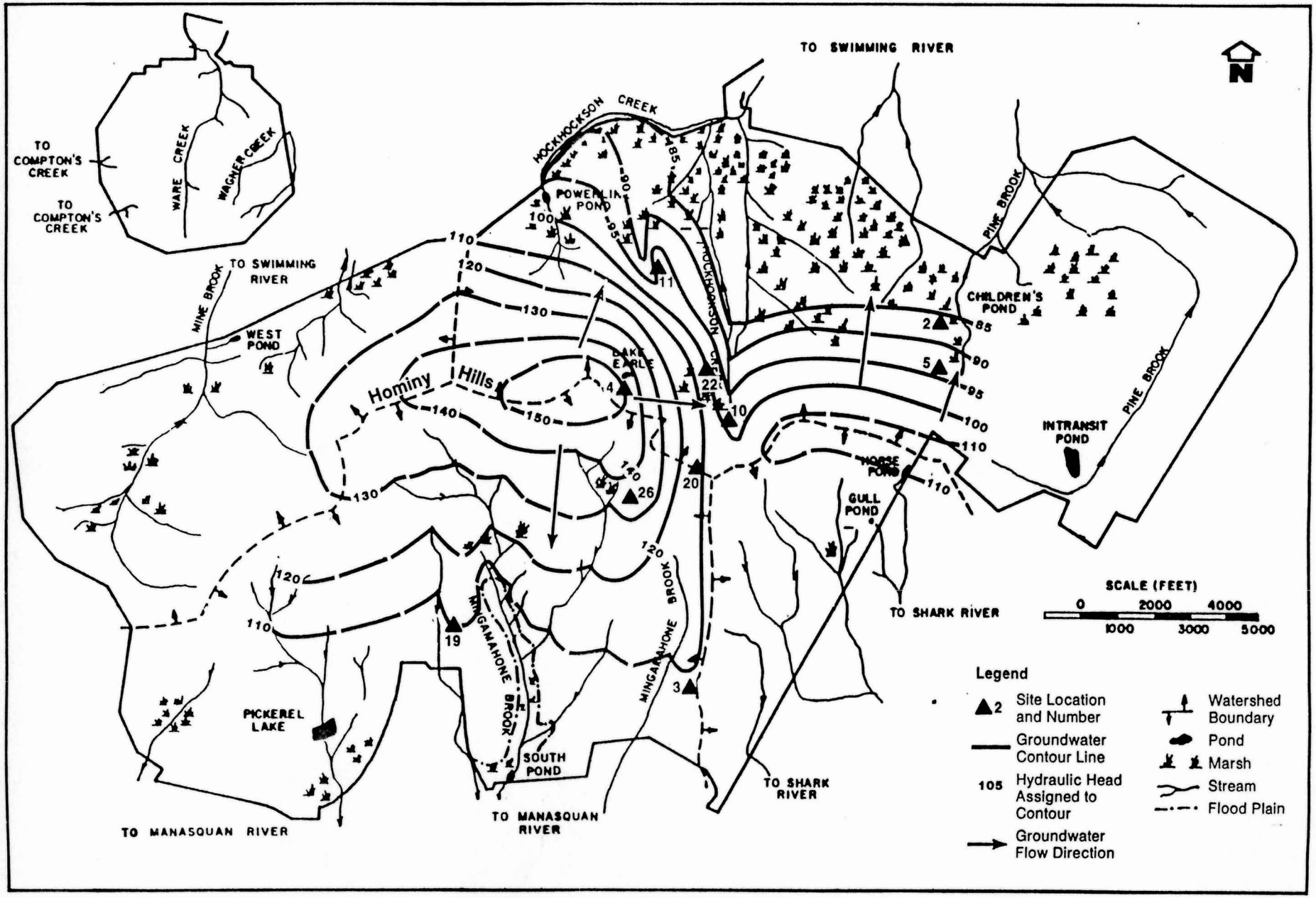


FIGURE 2-1 COMPOSITE SHALLOW GROUNDWATER SURFACE CONTOUR MAP FOR THE MAIN BASE, NWS EARLE

At the Main Base the most prevalent soils are described in the Soil Survey of Monmouth County, New Jersey (USDA, 1990), as follows:

- Atsion Series [At]: The Atsion Series consists of poorly drained soils on upland flats. These soils formed in acid, sandy Coastal Plain sediments. Slope ranges from 0 to 2%.
- Humaquepts [HV]: Humaquepts consist of somewhat poorly drained to very poorly drained soils on flood plains. These soils are subject to flooding several times each year. They formed in stratified, sandy or loamy sediments of fluvial origin. Slope ranges from 0 to 2%.
- Keyport Series [KeB]: The Keyport Series consists of moderately well drained soils on uplands. These soils formed in acid, clayey Coastal Plain sediments. Slope ranges from 0 to 15%.
- Lakehurst Series [LaA]: The Lakehurst Series consists of moderately well drained and somewhat poorly drained soils on uplands. These soils formed in acid, sandy, Coastal Plain sediments. Slope ranges from 0 to 2%.
- Lakewood Series [LeB]: The Lakewood Series consists of excessively drained soils on uplands. These soils formed in acid, sandy, Coastal Plain sediments. Slop ranges from 0 to 10%. Lakehurst soils are mottled in the subsoil.
- Udorthents [UA]: Udorthents consist of well-drained to somewhat poorly drained soils that have no horizonation. These soils formed in stratified or graded, sandy or loamy fill material that has as much as 35% gravel, by volume. Slope ranges from 0 to 3%. These soils have been altered in some way. In some areas the altering was filling over or excavating excessively drained to very poorly drained areas. They are strongly acid to extremely acid.

Soils in the Chapel Hill area include the Psamments and Tinton Series, which are generally well-drained sandy to loamy sand soils. Few streams and flood plains occur in the area. No black acid soils have been uncovered in the Chapel Hill area. The two soil associations found at Chapel Hill (waterfront area) are described in the Soil Survey of Monmouth County, New Jersey (USDA, 1990), as follows:

- Psamments [PN]: Psamments consist of excessively drained to somewhat poorly drained soils that have no horizonation. These soils formed in stratified or graded, sandy fill material. Slope ranges from 0 to 2%.

  These soils differ greatly from area to area. Thus, a typically pedon is not given. Typically, the soils are 20 to 60 inches deep or more to the original soil material or to waste fill. They are extremely acid or very strongly acid.

- Tinton Series [ToA]: The Tinton Series consists of well-drained soils on uplands and terraces. These soils formed in acid, loamy, Coastal Plain sediments that are 10 to 40% glauconite, by volume. Slope ranges from 0 to 25%.

2.1.5 Surficial Geology

The geologic setting at NWS Earle consists of a thick wedge of layered unconsolidated sediments that dip seaward (southeast). The sedimentary formations of the Coastal Plain are exposed at the surface in a banded outcrop pattern roughly parallel to the shore (see Figure 2-2).

These sedimentary units are formed of interbedded sands, gravel, silt, and clay. They tend to thicken downdip (in the seaward direction) because they were deposited on the edge of the ocean basin. The coarser, more permeable deposits form aquifers, while the interbedded fine sediments form confining beds that restrict the vertical flow of water.

The total thickness of the sediments over the crystalline bedrock basement is approximately 1,300 feet inland to more than 6,000 feet near the shore.

The sedimentary formations range in age from late Cretaceous to post-glacial. Rocks of intermediate age (post-Precambrian but pre-Cretaceous) were presumably removed by erosion prior to the deposition of the present strata. The depositional environment of the Coastal Plain sediments represents alternating periods of marine transgressions and

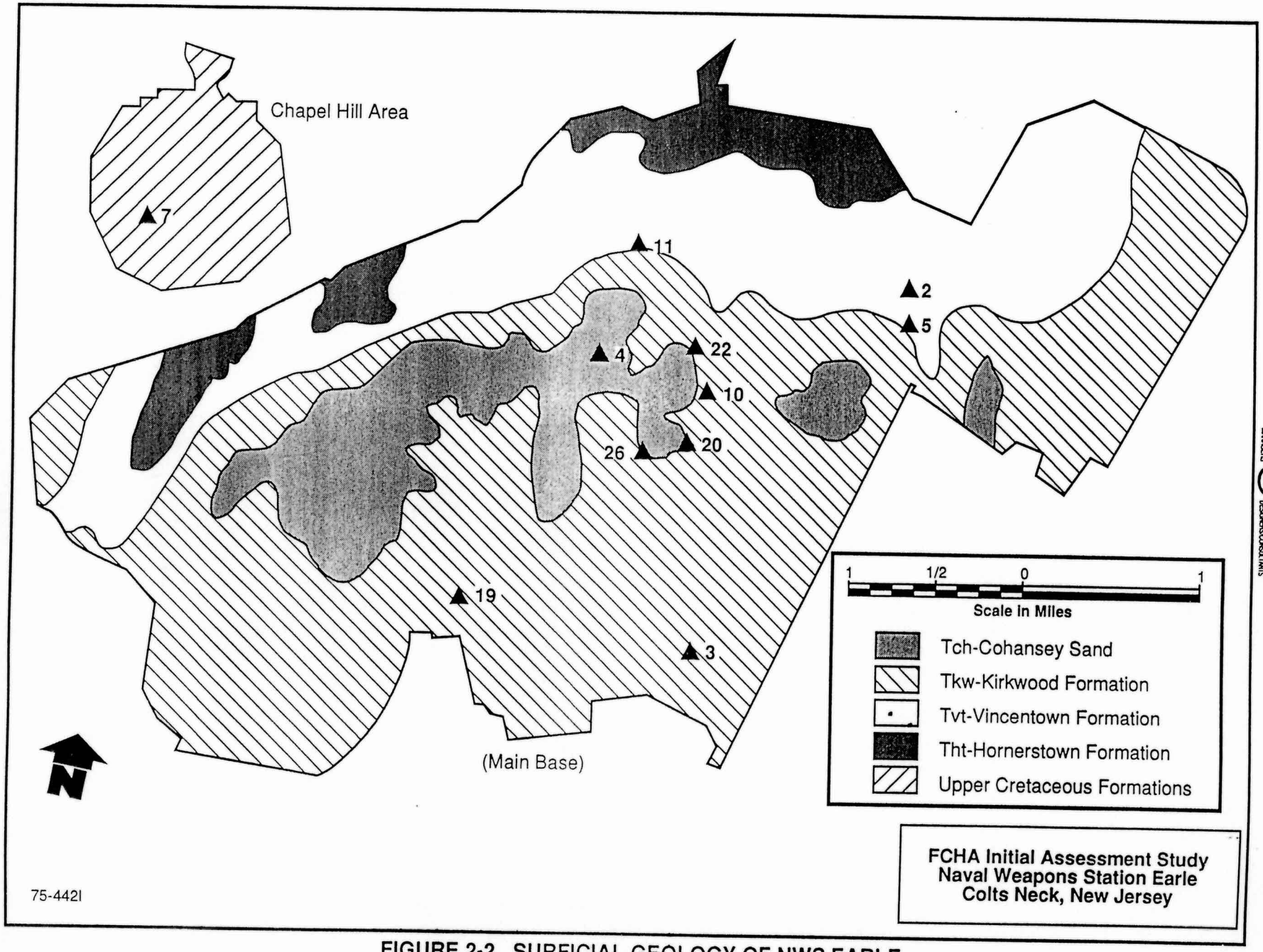


FIGURE 2-2 SURFICIAL GEOLOGY OF NWS EARLE

regressions. Finer-textured sediments represent quiet water conditions (i.e., deeper marine, swamp, marshes, or backshore lagoons), while coarser textures represent higher energy zones (i.e., beachfront stream or deltaic deposits). The last major depositional event resulted from the Pleistocene glaciation.

NWS Earle falls outside the southern limit of the Wisconsin terminal moraine. Minor transgressions of the sea due to glacial melting resulted in some Pleistocene deposits at lower elevations.

The oldest formation, located at the bottom of the sedimentary sequence, is the Raritan Formation, a medium- to coarse-grained arkosic sand unit up to 400 feet thick. Despite the presence of minor interbedded kaolinitic clay layers, it is a very important regional aquifer and supplies water for many municipal wells. Due to their similarity in composition, the Raritan is commonly considered with the next-youngest unit, the Magothy Formation. The Magothy is also dominantly sand (fine-grained, micaceous, and lignitic) and up to 175 feet thick, but the sands tend to be discontinuous and the clay interbeds more common than in the Raritan Formation. The Magothy and Raritan are both Cretaceous Age formations. Combined they are typically described in drillers' logs as a series of alternating sand and silt beds. Together, these two units form a deep, thick, and important regional aquifer.

The next five younger units, the Merchantville Formation up through the Wenonah Formation, are part of the upper Cretaceous Matawan Group. The Merchantville Formation, a 60-foot-thick, dark, micaceous, glauconitic silty clay, is often considered in combination with the overlying Woodbury Clay, also a gray to black micaceous clay 60 or more feet thick. Together, these two clays range in thickness from 120 feet inland to 250 feet near the shore. They are generally nonwater-bearing and act as a single aquitard.

The Englishtown Formation has a variable lithology that changes from a fine- to medium-grained sand inland to a clay-rich texture downdip, where it resembles the underlying Woodbury Formation and the overlying Marshalltown Formation. The Englishtown aquifer is an important source of water in Monmouth County.

SECTION 4

RESULTS OF THE FIELD INVESTIGATION

This section describes the results of the field investigation, including the presence of contaminants, the medium affected, and potential and observed pathways of contaminant migration. The section presents each site separately with the physical data first, followed by the chemical data. Data tables summarize significant "hits" for each medium and site. Groundwater sample results include three rounds of sampling and analysis: the first round was comprehensive (complete TCL/TAL scans for each well); the second and third rounds were for selected parameters. Comprehensive laboratory data packages and validation reports have been submitted to EPA separately. These reports are voluminous and cannot be included in this report.

Each site subsection in Section 4 is concluded with a characterization of the site as understood through current and past information. General site descriptions and histories are presented in Section 1. A discussion of the investigation conducted at each site are presented in Section 3. Well construction information, groundwater elevations, and the results of the slug test analysis are also tabulated in Section 3. The significance of the results is discussed in Section 5.

4.1 SITE 2: ORDNANCE DEMILITARIZATION SITE (ODS)

4.1.1 Physical Characteristics

Site 2 is approximately 11 acres in size and appears as a shallow, wide open, nonvegetated, oval-shaped sand pit with a high berm and bordered by woodlands. Two undeveloped dirt roads access the site, one from the south past Site 5, and one from the west from the direction of Piney Brook. The topography at the site slopes gently towards the north from approximately 125 feet above MSL at the bunker to approximately 90 feet MSL in the open detonation area. An elongated sand berm approximately 200 feet long and 15 feet high, oriented northeast to southwest, is situated in the center of the site.

Standing water and a few remnants of demilitarized or spent ordnance casings were observed during the field investigation (in January 1991) in several depressions located at the base of the berm in the northeastern portion of the site. A few large empty ordnance casings were also noted outside of the southeastern berm. With the exception of these few ordnance casings, the site appears to be generally free of debris and well maintained.

4.1.1.1 Soils and Sediments

The original soils within site proper (part of the Lakehurst Sands Series [LeB] Section 2) have been altered or excavated in the past, consequently exposing the upper sand unit of the Vincentown formation. Based on the samples obtained during the drilling and sampling, the shallow "soils" at Site 2 are generally characterized as sand, fine- to coarse-grained, quartz, some silt, olive green to olive brown (5y4/3 to 2.5y4/4 munsel color classification).

4.1.1.2 Drainage

Precipitation at the site collects, by way of overland flow, in the depressions in the northeastern portion of the site. Drainage at the site occurs through infiltration and evaporation. Infiltration is the main source of recharge to the shallow aquifer at the site and is a controlling factor of groundwater flow. This interrelationship is discussed in the following subsection.

The surface water body nearest to Site 2 is a small tributary of Piney Brook which is located approximately one-half mile northeast (downgradient) of Site 2.

4.1.1.3 Hydrogeology

The following lithologic description of the geologic materials at Site 2 was determined from the physical characterization of continuous split-spoon samples obtained from the SI and RI drilling activities. These descriptions are contained in the boring logs presented in Appendix A. The sediments underlying Site 2 consist of a relatively homogeneous matrix of very fine

to coarse quartz sand with some glauconite and silt, and vary in color from olive to very dark gray. These characteristics are consistent with the sediments which compose the lower member of the Vincentown Formation. Site 2 is situated within the outcrop and recharge area of the Vincentown Formation.

Generally groundwater levels range between 5 and 15 feet below ground surface across Site 2. Figure 4-1 presents groundwater elevation contours developed from water level elevations obtained in June 1991. Groundwater flow is toward the north mimicking topography with an average gradient of .005 feet/foot. This pattern is similar to that observed during other measurement rounds. MW 2-2 is hydraulically crossgradient of the site while MW 2-3 is the furthest downgradient. The groundwater flow velocity, V, in the shallow aquifer is related to the hydraulic gradient, i, and the hydraulic conductivity, K, of the sediments and can be calculated using the following expression of Darcy's Law:

$$V = Ki/n$$

Where n is the effective porosity of the sediments.

Porosity varies over a narrow range in sandy sediments and can be estimated at 0.3 without introducing a significant error. The hydraulic conductivities at Site 2 were determined from the aquifer slug tests conducted at several monitoring wells (see Appendix A). Based on the hydraulic conductivity calculated from the slug test data, the lateral groundwater flow velocity calculated from Darcy's Law (V = Ki/n) ranges from approximately .002 feet/day (MW 2-6) to 0.3 ft/day (MW 2-1) or 1 to 110 feet/year.

4.1.2 Chemical Results

4.1.2.1 Analysis of Soils and Sediments

The results of the soil sample analysis are presented on Table 4-1. Explosive compounds were not detected in any of the soil samples. Nineteen metals were detected in some or all of the samples. Each of these elements occurs to some extent in natural soils; therefore,

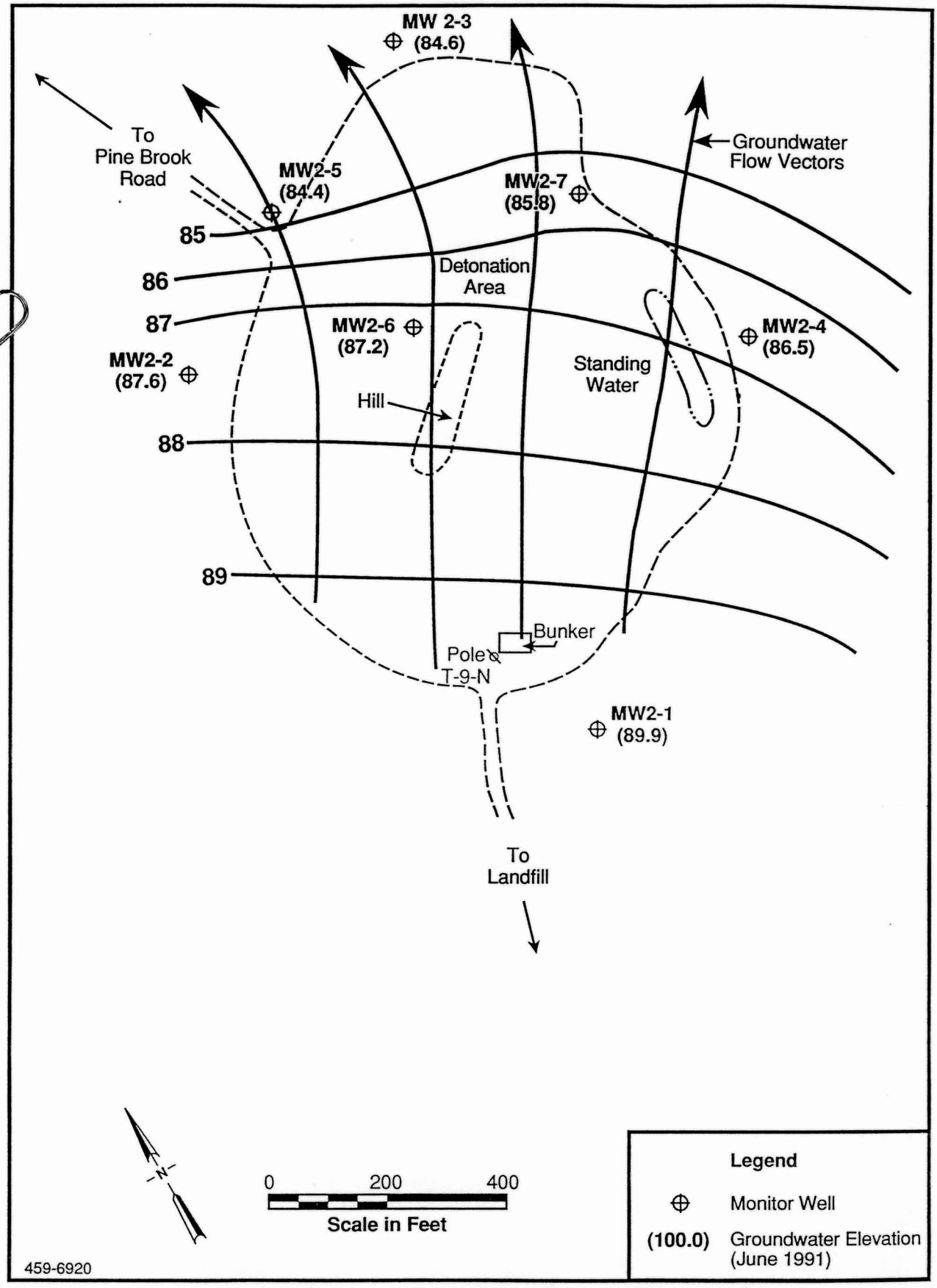


FIGURE 4-1 SITE 2 - ORDNANCE DEMILITARIZATION SITE GROUNDWATER SURFACE CONTOURS NWS EARLE, NJ

27 February, 1991

Table 4-1

Summary of Soil and Sediment Sample Analytical Results
NWS Earle, Site 2 (ODS)

Site I.D. / Compounds	02-001-D001 Sediment Sample 2-001	02-002-D001 Sediment Sample 2-002	02-003-D001 Sediment Sample 2-003	02-004-S001 Soil Sample 2-004	02-004-S201 Soil Sample 02-004 (Eq. Blank)	02-004-S201 Replicate	02-005-S001 Soil Sample 02-005	02-006-S001 Soil Sample 02-006	02-006-S001 Replicate	02-006-S101 Soil Sample 02-006 (Dup.)	02-007-S001 Soil Sample 02-007	02-008-S001 Soil Sample 02-008	02-008-S001 Replicate	NJDEP Guidelines (mg/kg = ppm)
Inorganics (mg/kg)														
Blanks are in mg/l														
Aluminum	10300	7640	9650	3860	0.021	NR	3030	3650	NR	3710	8490	4970	4807	–
Arsenic	6.3	7.5	4.7	1.7	U	NR	3.0	3.8	NR	4.6	7.5	6.1	6.8	20
Barium	7.5	10.1	5.3	1.3	U	NR	2.0	1.3	NR	1.4	2.0	1.5	1.3	400
Beryllium	1.2	1.0	1.1	0.43	U	NR	0.28	0.41	NR	0.44	1.1	0.66	0.60	–
Calcium	44.5	14.5	7.6	15.0	0.17	NR	4.2	12.0	NR	9.9	15.4	4.9	4.6	–
Cadmium	1.2	U	U	U	U	NR	U	U	NR	U	U	U	U	3
Cobalt	1.4	1.1	1.1	U	U	NR	U	U	NR	U	1.4	U	U	–
Chromium	286	227	208	92.0	U	NR	71.1	93.5	NR	81.9	265	183	184	100
Copper	12.6	17.6	4.1	3.4	0.021	NR	2.8	1.6	NR	1.6	4.2	1.1	1.6	170
Iron	41300	30000	32700	13800	0.068	NR	12800	12400	NR	12900	33900	19000	18030	–
Potassium	6560	4650	6130	2040	U	NR	1400	2110	NR	2240	6480	2630	2398	–
Nitrate	1.3	1.2	1.7	3.1	0.34	0.34	2.9	1.4	NR	2.9	1.7	1.0	1.0	–
Magnesium	2150	1490	2160	686	U	NR	502	727	NR	788	2050	847	771	–
Manganese	10.6	6.8	8.3	6.5	0.0011	NR	3.9	3.8	NR	3.5	6.1	4.6	4.5	–
Sodium	36.3	10.3	11.2	32.2	0.19	NR	5.0	50.4	NR	21.6	17.7	8.4	7.2	–
Lead	27.0	19.3	7.2	7.5	U	NR	10.8	4.0	NR	3.8	5.5	4.7	5.4	250-1000
Selenium	U	U	U	U	U	NR	U	U	NR	0.34	0.65	U	U	4
Vanadium	210	187	149	81.6	U	NR	66.6	61.4	NR	61.5	168	117	118	–
Zinc	26.6	21.1	21.3	10.2	0.0053	NR	6.2	12.4	NR	7.4	21.1	9.5	8.8	350
% Solids (%)	66.2	68.6	71.8	84.4	NR	NR	81.5	85.6	85.1	86.2	86.0	88.0	NR	–
Explosives (U)														

Legend: U = Not detected
NR = Not requested
(a) = Refer to June 90 QAAP

Replicate = Lab QA sample

they are only considered present as introduced "contaminants" if they occur above normal soil "background" levels.

Precise background soil composition and chemistry can vary considerably from location to location, and specific background samples were not taken for Site 2. However, the pattern and distribution of metals in the samples appear to be in a normal "background" range when considered in several ways. First the concentrations of all of the metals are in or below normal concentrations for crustal rocks and sediments (Mason, 1966) or soils of the east coast of the United States (Shacklette and Boerngen 1984). These concentrations are presented as a range of values on Table 4-2. Second, the relative concentration of metals in samples does not vary greatly between samples, and the concentrations of individual metals are in the same order of magnitude range for all samples. If "contamination" was present, it would be observed in the form of anomalously high concentrations in some samples for individual metals or groups of metals. Therefore, it is concluded that the metals concentrations observed in the soil samples at Site 2 represent ambient soil concentrations.

4.1.2.2 Analysis of Groundwater

The groundwater quality results for the three sampling rounds are presented on Tables 4-3a, 4-3b, and 4-3c. Table 4-3a presents the first sampling round which was the most comprehensive including the full EPA TCL/TAL scans plus explosive compounds. Only one semivolatile compound was found (bis{2-ethylhexyl}phthalate at a concentration of 1J μg/L, below quantifiable detection limits in six samples). No pesticides or PCBs were detected in the groundwater samples. Subsequently, the round two and three sampling included VOCs, drinking water metals, and explosive compounds. Three volatile compounds, methylene chloride, acetone, and chloroform, were detected in almost all samples, including the upgradient well MW 2-01, in all three rounds of sampling. The first two compounds were also detected in the blanks and are common solvents in the laboratory and field decontamination, respectively. Chloroform was also found at concentrations near the detection limit of 5 μg/L, and was also detected in some of the blanks.

Table 4-2

Naturally Occurring Concentrations of Elements in Rock and Soil

Metal	Average Concentration in the Earth's Crust (ppm)[2]	Ranges of Metals Concentrations in Natural Soils in North America[1] Concentration Range (ppm) Except Where Noted
Aluminum (%)	8.13	1-30
Arsenic	1.8	1-50
Barium	10	100-5,000
Beryllium	2.8	0.1-40
Cadmium	0.2	0.01-7.0
Calcium (%)	3.6	0.01-28
Chromium	100	1-1,000
Cobalt	25	1-40
Copper	55	2-200
Iron	50,000	14,000-42,000
Lead	13	2-200
Manganese	950	2-4,000
Mercury	0.08	0.02-0.30
Nickel	75	5-500
Potassium (%)	2	0.005-3.7
Selenium	.05	0.1-2.0
Silver	.07	0.1-5.0
Vanadium	135	20-500
Zinc	70	10-300

[1]References: Pressant (1971)
Allaway (1968)
EPA (1983)

[2]Mason (1966)

Table 4-3a
Summary of Groundwater Sample Analytical Results
Round One: March, 1991
NWS Earle, Site 2 (ODS)

Site I.D. (a) / Compounds	02-001-M001 MW2-01	02-001-M001 Replicate	02-002-M001 MW2-02	02-003-M001 MW2-03	02-003-M101 MW2-03 (DUP.)	02-003-M201 MW2-03 (Eqpt Blank)	02-003-M301 MW2-03 (Trip Blank)	02-004-M001 MW2-04	02-005-M001 MW2-05	02-006-M001 MW2-06	02-007-M001 MW2-07	Primary Drinking Water Standards
Semivolatiles (ug/l)												
bis(2-Ethylhexyl) phthalate	1 J	NR	1 J	1 J	1 J	U	NR	U	1 J	U	1 J	-
Volatile Organics (ug/l)												
Methylene Chloride	28 B	NR	58 B	54 B	54 B	55 B	4 JB	4 JB	3 JB	2 JB	3 JB	-
Acetone	18 B	NR	11 B	20 B	14 B	23 B	92 B	7 JB	210 B	11 B	9 JB	-
Chloroform	8.0	NR	4 J	U	U	6.0	5.0	4 J	2 J	U	U	-
Inorganics (mg/l)												
Nitrate	0.14	0.15	0.14	0.17	0.22	0.40	NR	0.24	0.44	0.16	1.9	10.0
Nitrite	U	U	U	U	U	U	NR	U	U	U	U	1.0
Aluminum	0.41	NR	3.0	U	5.9	0.051	NR	0.31	45.4	11.4	13.4	-
Barium	0.019	NR	0.055	U	0.018	U	NR	0.012	0.11	0.072	0.035	1.0
Beryllium	U	NR	U	U	0.00060	U	NR	U	0.0083	0.0014	0.0025	0.001
Calcium	0.60	NR	1.5	0.038	0.87	0.11	NR	0.33	10.6	33.2	5.2	-
Cadmium	U	NR	U	U	U	U	NR	U	U	U	0.0045	0.005
Cobalt	U	NR	U	U	U	U	NR	U	0.0098	0.0050	U	-
Chromium	0.0081	NR	0.036	U	0.068	U	NR	0.012	1.5	0.33	0.33	0.1
Copper	U	NR	U	U	U	U	NR	U	0.022	0.026	0.026	1.3
Cyanide	U	NR	U	U	U	U	NR	U	U	U	U	-
Iron	0.59	NR	5.3	0.0088	9.6	0.026	NR	1.3	202	42.0	51.3	-
Mercury	U	NR	U	U	U	U	NR	U	U	0.00028	U	0.002
Potassium	1.5	NR	1.8	9.9	9.4	U	NR	1.6	34.4	8.9	10.3	-
Magnesium	1.5	NR	1.2	U	0.98	0.066	NR	1.0	11.9	5.7	4.1	-
Manganese	0.0066	NR	0.058	U	0.020	U	NR	0.0047	0.17	0.18	0.079	-
Sodium	4.5	NR	4.2	0.056	4.7	0.30	NR	3.3	2.5	3.3	13.5	-
Nickel	U	NR	U	U	U	U	NR	U	U	0.0044	0.051	-
Lead	0.0033	NR	0.0014	0.0068	0.0056	U	NR	0.0020	0.028	0.015	0.021	0.015
Antimony	U	NR	U	U	U	U	NR	U	0.013	U	U	-
Vanadium	U	NR	0.025	U	0.045	U	NR	0.0040	1.1	0.19	0.28	-
Zinc	0.017	NR	0.078	U	0.057	0.0054	NR	0.015	0.19	0.067	0.091	-
Explosives												
Picric Acid (ug/l)	U	NR	U	U	U	U	NR	U	U	2.1	U	-
RDX (ug/l)	U	NR	U	U	U	U	NR	U	U	4.12	U	-
2,4-DNT (ug/l)	U	NR	U	U	U	U	NR	U	U	3.2	U	-
Nocellulose/Nglycerine (mg/l)	U	NR	U	U	2.9	U	NR	U	U	U	U	-
Pesticide/PCB (U)												

Legend: U = Not detected
NR = Not requested
B = Detection limit found in blank
J = Present below detection limit
(a) = Refer to June 90 QAAP
Replicate = Lab QA sample

Table 4–3b
Summary of Groundwater Sample Analytical Results
Round Two: October 1991
NWS Earle, Site 2 (ODS)

Site I.D. (a) / Compounds	02–001–M002 MW02–01	02–001–M002 Replicate	02–001–M202 MW02–01(Eqpt Bk)	02–001–M302 MW02–01(Trip Bk)	02–002–M002 MW02–02	02–003–M002 MW02–03
Volatile Organics (ug/l)						
Methylene Chloride	17 JB	NR	4 JB	5 B	2 JB	1 JB
Acetone	620 B	NR	100 B	6 JB	18 B	16 B
Chloroform	7 J	NR	U 5	U 5	5	U 5
Benzene	U 25	NR	U 5	U 5	U 5	U 5
Inorganics (ug/l)						
Barium	U 200	U 200	U 200	NR	U 200	U 200
Cadmium	U 5	U 5	U 5	NR	U 5	U 5
Chromium	23.4	26.2	U 10	NR	432	32.7
Copper	U 25	U 25	U 25	NR	U 25	U 25
Iron	2230	2090	U 100	NR	52600	4860
Mercury	U 0.2	U 0.2	U 0.2	NR	U 0.2	U 0.2
Manganese	U 15	U 15	U 15	NR	61.9	30.7
Sodium	U 5000	U 5000	U 5000	NR	U 5000	U 5000
Lead	U 3	U 3	U 3	NR	7	U 3
Zinc	50	U 20	U 20	NR	91.3	52.5
Explosives (ug/l)						
1,3,5–TNB	0.5 P	NR	NR	NR	NR	3.02 G
RDX	U 0.63	NR	NR	NR	NR	U 0.63
2,4–DNT	U 0.78	NR	NR	NR	NR	U 0.78
Nitrate, as N	0.11	NR	U 0.1	NR	NR	0.16

Legend U = Not detected
NR = Not detected
B = Detection limit found in blank
J = Present below detection limit
G = Elevated detection limit due to interference
P = Present below detection limit
(a) = Refer to June 90 QAAP
Replicate = Lab QA sample

Table 4–3b Cont.....
Summary of Groundwater Sample Analytical Results
Round Two: October 1991
NWS Earle, Site 2 (ODS)

Site I.D. (a) / Compounds	02–004–M002 MW02–04	02–005–M002 MW02–05	02–006–M002 MW02–06	02–006–M002 Replicate	02–007–M002 MW02–07
Volatile Organics (ug/l)					
Methylene Chloride	5 B	1 JB	U 5	NR	2 JB
Acetone	11 B	15 B	35 B	NR	40 B
Chloroform	3 J	4 J	U 5	NR	U 5
Benzene	U 5	U 5	4 J	NR	U 5
Inorganics (ug/l)					
Barium	U 200	U 200	U 200	NR	292
Cadmium	U 5	U 5	U 5	NR	5
Chromium	400	108	310	NR	2360
Copper	U 25	U 25	U 25	NR	54.4
Iron	62200	14800	42000	NR	3E+05
Mercury	U 0.2	U 0.2	1.1	NR	0.39
Manganese	45.5	27.8	328	NR	819
Sodium	U 5000	U 5000	U 5000	NR	12500
Lead	6.2	3	6.7	NR	190
Zinc	82.8	29.6	74.2	NR	817
Explosives (ug/l)					
1,3,5–TNB	NR	NR	0.84 G	NR	NR
RDX	NR	NR	5.91	NR	NR
2,4–DNT	NR	NR	1.61	NR	NR
Nitrate, as N	NR	NR	0.43	0.43	NR

Legend U = Not detected
NR = Not detected
B = Detection limit found in blank
J = Present below detection limit
G = Elevated detection limit due to interference
P = Present below detection limit
(a) = Refer to June 90 QAAP
Replicate = Lab QA sample

Table 4-3c
Summary of Groundwater Sample Analytical Results
Round Three: November 1991
NWS Earle, Site 2 (ODS)

Site I.D. (a) / Compounds	02-001-M003 MW02-01	02-001-M203 MW02-01(Eqpt Bk)	02-002-M003 MW02-002	02-002-M003 REPLICATE	02-003-M003 MW02-003	02-003-M003 REPLICATE
Volatile Organics (ug/l)						
Methylene Chloride	3 JB	4 JB	2 JB	NR	3 JB	NR
Acetone	100 B	180 B	820 E	NR	590 E	NR
Chloroform	6	7	6	NR	U 5	NR
Benzene	U 5	U 5	U 5	NR	U 5	NR
Inorganics (ug/l)						
Barium	U 200	U 200	U 200	U 200	U 200	NR
Chromium	15.4	U 10	78.9	89.9	26.6	NR
Copper	U 25	U 25	U 25	U 25	U 25	NR
Iron	3260	U 100	9770	11600	3670	NR
Mercury	U 0.2	U 0.2	U 0.2	NR	U 0.2	NR
Manganese	U 15	U 15	41.2	40.8	17.4	NR
Sodium	U 5000	U 5000	U 5000	U 5000	U 5000	NR
Lead	3.3	U 3	U 3	U 3	U 3	NR
Zinc	21.4	U 20	85	74.9	44.5	NR
Explosives (ug/l)						
HMX	U 1.3	U 1.3	NR	NR	U 1.3	NR
RDX	U 0.63	U 0.63	NR	NR	U 0.63	NR
1,3,5-TNB	U 0.56	U 0.56	NR	NR	U* 0.56	NR
TETRYL	U 0.66	U 0.66	NR	NR	U 0.66	NR
2,4-DNT	U 0.6	U 0.6	NR	NR	U 0.6	NR
Nitrate, as N	U 0.1	U 0.1	NR	NR	0.35	0.36

Legend U = Not detected

NR = Not requested

B = Detection limit found in blank

J = Present below detection limit

E = Detection beyond calibration range, but no dilution analysis due to suspected field contamination

REPLICATE = Lab QA sample

(a) = Refer to June 90 QAAP

Table 4 –3c cont.....

Summary of Groundwater Sample Analytical Results
Round Three: November 1991
NWS Earle, Site 2 (EOD Range)

Site I.D.(a)	02–004–M003	02–004–M203	02–005–M003	02–006–M003	02–007–M003	02–007–M303
	MW02–004	MW02–004(Eqpt Bk)	MW02–005	MW02–006	MW02–007	MW02–07(Trip Bk)
Compounds						
Volatile Organics (ug/l)						
Methylene Chloride	U 5	4 JB	1 JB	4 JB	2 JB	4 JB
Acetone	170 B	330 E	160 B	470 E	290 E	120 B
Chloroform	3 J	U 5	6	U 5	U 5	U 5
Benzene	U 5	U 5	U 5	2 J	U 5	U 5
Inorganics (ug/l)						
Barium	U 200	U 200	U 200	NR	228	NR
Chromium	U 10	U 10	82.6	NR	2370	NR
Copper	U 25	U 25	U 25	NR	62.6	NR
Iron	350	U 100	11100	NR	3E+05	NR
Mercury	U 0.2	U 0.2	U 0.2	NR	0.3	NR
Manganese	U 15	U 15	22.8	NR	496	NR
Sodium	U 5000	U 5000	U 5000	NR	14900	NR
Lead	5.9	U 3	U 3	NR	130	NR
Zinc	41.6	24.9	49.5	NR	657	NR
Explosives (ug/l)						
HMX	NR	NR	NR	0.81 J	NR	NR
RDX	NR	NR	NR	4.21	NR	NR
1,3,5–TNB	NR	NR	NR	0.54 J	NR	NR
TETRYL	NR	NR	NR	1.15	NR	NR
2,4–DNT	NR	NR	NR	1.59	NR	NR
Nitrate, as N	NR	NR	NR	13.3	NR	NR

Legend U = Not detected

NR = Not requested

B = Detection limit found in blank

J = Present below detection limit

E = Detection beyond calibration range, but no dilution analysis due to suspected field contamination

REPLICATE = Lab QA sample

(a) = Refer to June 90 QAAP

The first round of TAL inorganic analysis was followed by analysis limited to the drinking water metals in the second and third sampling round. Iron was typically high in all of the wells (1-50 mg/L, 2.2 mg/L in upgradient well MW 2-01) and is typical for area groundwater. Zinc was also detected in the range of .020-.085 mg/L, 17-50 in MW 2-01. Chromium was elevated (0.10 mg/L) in wells MW 2-04, 2-05, 2-06, and 2-07 for most sampling rounds. The highest detection was 2.3 mg/L in MW 2-07 in the third round. Lead was also detected in the first round in most wells at low levels, including MW 2-01(< .020 mg/L). The subsequent sampling rounds did not confirm the earlier lead results. In one case, MW 02-07 showed relatively high lead levels in the second and third rounds of sampling (0.13-.019 mg/L), but not in the first round.

Explosive-related compounds were detected at very low levels in wells MW 2-03 (nitro cellulose at 2.9 mg/L) and MW 2-06 (<10 μg/L total picric acid, RDX and 2,4, DNT) and in no other well in the first round. The two wells were resampled for explosives analysis during the second and third rounds with similar results for MW 02-6. Only nitrates were found in MW 2-03. MW 2-06 is within the detonation area, while MW 2-03 is downgradient of the site.

4.1.3 Summary of the Site 2 Characterization

Site 2 has been and is currently used as an explosives detonation area on an occasional basis. No open burning or dumping of raw material occurs which is consistent with the soils analysis which showed no explosive compounds present. Very low concentrations of explosive compounds were found in one well in the detonation area and one directly downgradient. However, the occurrence of explosive compounds in groundwater and soils overall at Site 2 appears minimal and off-site migration is not apparent as evidenced by the absence of explosive compounds at downgradient boundary well MW 2-03.

The levels of metals in soil and sediment samples appear to be within normal background levels. The occurrence of certain metals in groundwater samples showed some anomalies. Part of this may be explained by the fact that samples were not filtered prior to preservation

and the samples were not totally free of turbidity. Iron concentrations were high and varied considerably between wells and sampling events. There is no health risk-based standard for iron, but levels above 1 mg/L would require pretreatment before use for taste and aesthetic reasons. High iron content is a common naturally occurring condition in area groundwater, and the variation observed in Site 2 wells is probably within normal background levels. No other contaminants were observed which could have resulted in additional mobilization of iron from soils.

Chromium, which was also found in the soils, was found in several downgradient wells above 0.1 mg/L, which is the current MCL. Lead, which was not found in the soil and sediment samples, was also detected in MW 2-07 at levels above the 50 mg/L MCL for lead, and at lesser concentrations in several other wells. The association of chrome or lead with site activities is unknown, and chrome appears to be widely distributed in the soils at the site. These metals typically are attenuated in soils and are not highly mobile in groundwater. Their presence in unfiltered samples from the shallow groundwater does not imply significant mobility.

The presence of relatively elevated metals in groundwater samples in this and other sites appears more a function of ambient soil conditions (natural or broadly impacted by human activities) plus the unfiltered sample protocol, than any past site activities.

4.2 SITE 3: LANDFILL SOUTHWEST OF "F" GROUP

4.2.1. Physical Characteristics

Site 3 is approximately 5 acres in size and appears as a wide open area surrounded by woodlands. The site is moderately vegetated with grasses and some scrub pines, with the exception of a few scarred areas (on the order of 20 feet in diameter) where no vegetation exists. An undeveloped dirt road accesses the site, one from the southeast past the F group bunkers. The topography across the site is relatively flat, between 120 and 125 feet above MSL. However, some relief along the south and southeastern boundaries of the site, in the vicinity of monitoring well MW 3-1, suggests that the edge of the fill tapers out to the

5.2 ORDNANCE DISPOSAL SITES

This group includes Sites 2, 11, and 26. Explosives material was disposed of at all three sites in different ways. Site 2 was a detonation area; Site 11 was a burning area; and Site 26 was a casing-rinse disposal pit.

In all three cases, residues of explosive compounds in soils and groundwater were not detected in most samples and were near detection limits in a few samples. The lack of residual explosives compounds probably is a function of the small quantities initially involved along with their induced or natural chemical breakdown. Table 5-3 lists possible contaminants of concern identified on a preliminary basis by site and by media. The solvent compound TCE stands out at Site 26 in well MW 26-01 where it was detected as high as 660 μg/L. Based on the other data, this result is not associated with the disposal pit and probably has another source, possibly a nearby septic tank.

5.3 GRIT BLASTING/PAINT CHIP DISPOSAL SITES

This group includes Sites 19, 20, and 22, where paint chip residues from sandblasting operations were disposed of directly on the ground. The raw material is visible on the ground at these sites, and the volumes are relatively small.

Surface sampling of waste piles, drainageways, and soils has delineated the nature and extent of waste material. Transport has occurred in surface drainage related to each of the sites. The extent of contamination is well defined by the sampling results.

Table 5-4 lists contaminants of concern identified on a preliminary basis by site and by media compared to proposed cleanup standards recently promulgated by DEPE in February 1992. Metal concentrations in groundwater are addressed separately in the following subsection.

TABLE 5-3
CONTAMINANTS OF CONCERN
(Ordnance Disposal Sites)

Ordnance Disposal Sites

Site ID	Medium	Location	Contaminant	Concentraion	Comment	MCL's For Drinking Water PRIMARY & SECONDARY	(NJDEPE Proposed Standards for Non-Residential Surface Soils 2/92)***
Site 2							
	Groundwater						
		MW2-03	N-C/N-G	2.9 mg/l	first round duplicate only	Not listed	
		MW2-06					
			Nitrate	U, 0.43, 13.3 mg/l		10,000 ug/l	
			Picric Acid	2.1, ND, ND ug/l		Not listed	
			RDX	4.12, 5.91, &4.21 ug/l		Not listed	
			2,4 DNT	3.2, 1.61, &1.59 ug/l		Not listed	
			Tetryl	ND, ND, 1.15 ug/l		Not listed	
			HMX	ND, ND, 0.18J ug/l		Not listed	
			1,3,5 TNB	U, U, 0.54J ug/l		Not listed	
Site 11							
	Soil						
		9 Samples	TPH	11-640 mg/Kg			TPH
	Groundwater						
		MW11-01	Chloroform	6,3J, &5 ug/L		Not listed	
		MW11-03	Chloroform	ND, ND, 2J ug/L		Not listed	
Site 26							
	Sediment	26-004	Picric Acid	14 ug/g			Not listed
		26-004(DUP)	Picric Acid	27 ug/g			Not listed
	Groundwater	MW26-001	TCE	660, 120, 240 ug/L		5 ug/l	
			1, 2-DCE	810, 420, 600 ug/L		Not listed	
			1, 1-DCA	3J, ND, ND ug/L		5 ug/l	
			Toluene	1J, ND, ND ug/L		1000 ug/l	
			xylene	3J, 1J, ND ug/L		10,000 ug/l	
			2,4,4 TNT	1.27, ND, ND ug/L		Not listed	
			Nitrate	ND, 1.1, 1.5 mg/L		1000 ug/l	
		MW26-004	N-C/N-G	3.9, ND, ND ug/L		Not listed	
			RDX	ND, 0.94, ND ug/L		Not listed	
			Nitrate	ND, 0.55, 0.14 mg/L		1000 ug/l	

***Proposed New Rule for Cleanup Standards for Contaminated Sites Issued By the NJDEPE February 3, 1992 are not enforcable until Adopted as Final Regulations, however they may be used as guidance to determine if a site is to be considered contaminated.

5.4 SHALLOW GROUNDWATER METALS CONCENTRATIONS

The presence of metals in groundwater is being addressed as a separate issue in this section, because an initial review of the site data showed that metals were detected in almost all wells at all sites at concentrations that varied significantly from round to round of sampling. The heavy metals that may be of concern at the sites include lead, chromium, and zinc, which occur naturally in area soils. Groundwater samples, as per EPA protocol, were not filtered prior to preservation, and thus it was suspected that sample turbidity could affect results. In order to examine distribution patterns of metals of interest a series of graphs (presented at the end of Section 5) were prepared to compare the following:

- Distribution of chromium, zinc, lead, and iron (which is an abundant naturally occurring element).
- Distribution of the above-listed metals in background wells for all sites for each sampling round.
- Distribution of the above-listed metals at all wells at each site for each sampling round.

Based on the analytical results, the following conclusions can be made:

- Generally, for Sites 10 and 11, the concentrations of metals in downgradient wells are similar to upgradient wells. At the other seven sites, one or more of the downgradient wells show concentrations of metals higher than the calculated mean values for upgradient wells.
- For most wells, metals concentrations were highly variable between sampling rounds. Where turbidity was measured (landfill wells, second and third rounds), there is frequent but not complete correlation between level of metals concentrations and turbidity between the two rounds.
- Mean concentrations, shown in Table 5-5, for chromium, iron, lead, and zinc in background wells were 91; 22,447; 10; and 48 μg/L, respectively.
- The highest concentrations of chromium and iron in background wells were found in MW 5-8 at 1,200 and 150,000 μg/L, respectively. Lead and zinc concentrations in background wells were highest in MW 3-6 at 51.3 and 213 μg/L, respectively.

TABLE 5-5
NWS Earle, Background Monitoring Wells
(MEAN CONCENTRATIONS FOR KEY METALS
IN UPGRADIENT MONITORING WELLS)

Compounds (ug/L)	MW2-01	MW3-02	MW3-06	MW4-4	MW5-8	MW7-3	MW10-3	MW11-2	MW19-1	MW26-3	
Chromium											
Round 1: March, 1991	8.1	U	41	U	1200	30	23	U	47	U	
Round 2: October, 1991	23.4	-	209	15.9	155	U	68.1	213	61	U	
Round 3: November, 1991	15.4	-	114	24.3	104	30.1	21.3	108	44.6	U	
										MAX	1200
								STD. DEVIATION	215.21	MIN	U
								(Calculated with outlying value=1,200 ug/l)		MEAN	91
Iron											
Round 1: March, 1991	590	10900	20700	12600	150000	30300	4900	1200	5400	2600	
Round 2: October, 1991	2230	-	113000	23400	21600	9070	7420	32000	7520	3200	
Round 3: November, 1991	3260	-	56400	17400	13300	48200	4490	16600	6980	3270	
										MAX	150000
								STD. DEVIATION	32854.91	MIN	590
								(Calculated with outlying value=150,000 ug/l)		MEAN	22447
Lead											
Round 1: March, 1991	3.3	2	22	6	38	10	2.1	1.6	4.8	3.5	
Round 2: October, 1991	3	-	51.3	6.9	U	6.1	5.9	20.3	9.1	U	
Round 3: November, 1991	3.3	-	24.9	17.3	4.2	10.7	14	U	12.3	U	
										MAX	51.3
								STD. DEVIATION	11.72	MIN	U
								9		MEAN	10
Zinc											
Round 1: March, 1991	17	42	16	49	120	11	18	37	U	6.7	
Round 2: October, 1991	50		213	68.4	47.9	U	32.4	58.8	23.5	U	
Round 3: November, 1991	21.4		99.2	156	45.4	58.2	U	77.7	39.8	43.4	
										MAX	213
										MIN	U
								STD. DEVIATION	48.15	MEAN	48

- Table 5-6 lists downgradient wells with chromium, lead, and zinc in excess of the National Drinking Water Standards. Sites 4 and 26 have no downgradient wells exceeding MCLs for chromium or lead or secondary MCLs for zinc. Sites 3, 5, and 11 exceeded MCLs for chromium in up- and downgradient wells, although downgradient concentrations were higher. Elevated chromium was more common at all sites, but in all the sites with wells exceeding MCLs for chromium, one or more wells also exceeded MCLs for lead. Except in one sample, upgradient wells were below MCLs for lead.

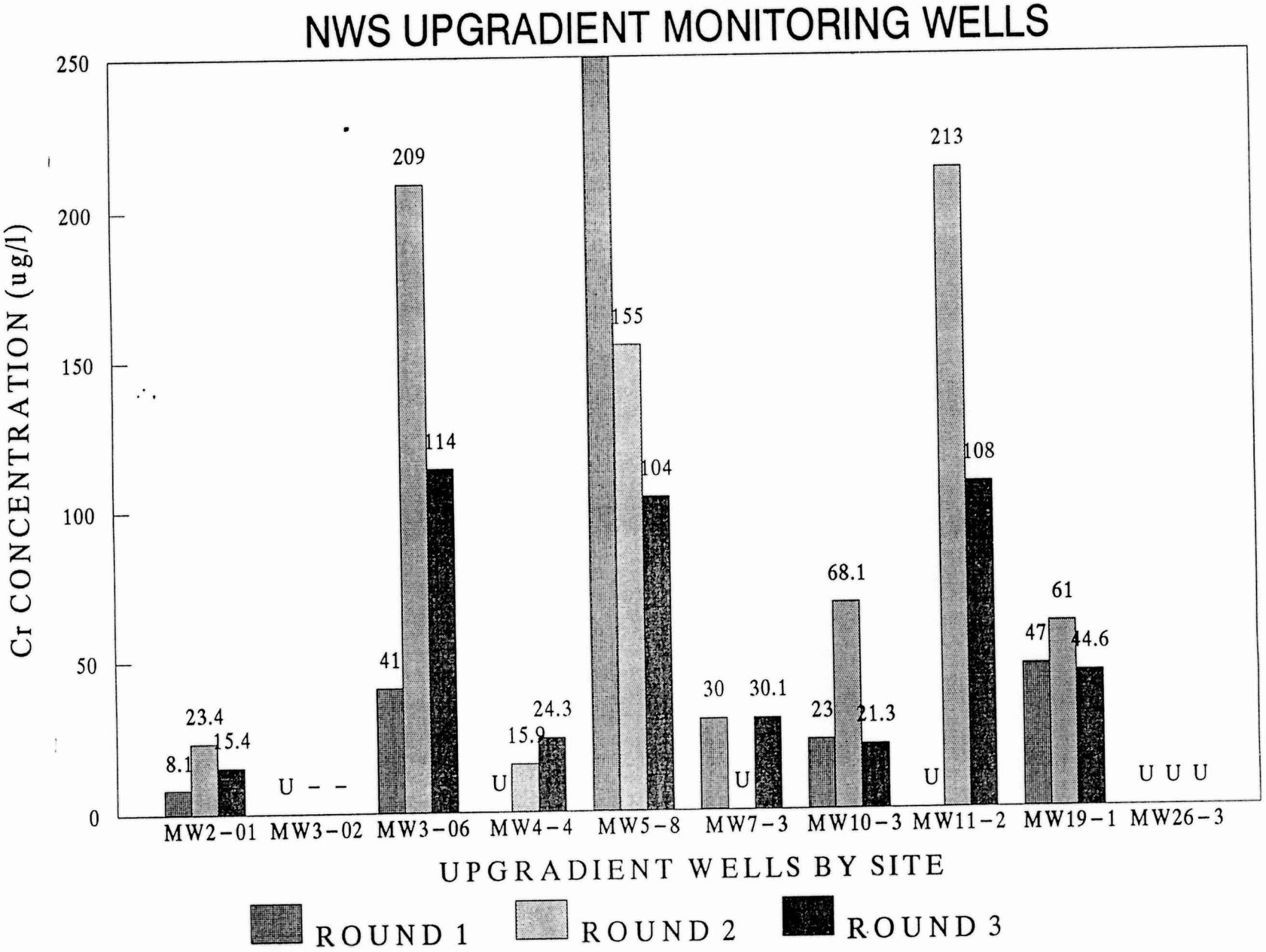
In summary, the overall impact of metals concentration on the sites was not precisely determined because of sample turbidity and natural abundance of metals in soils. However, some trends are evident in a qualitive review of the tabulated and graphical data presentations. Several sites show noticeable differences between up and downgradient water quality.

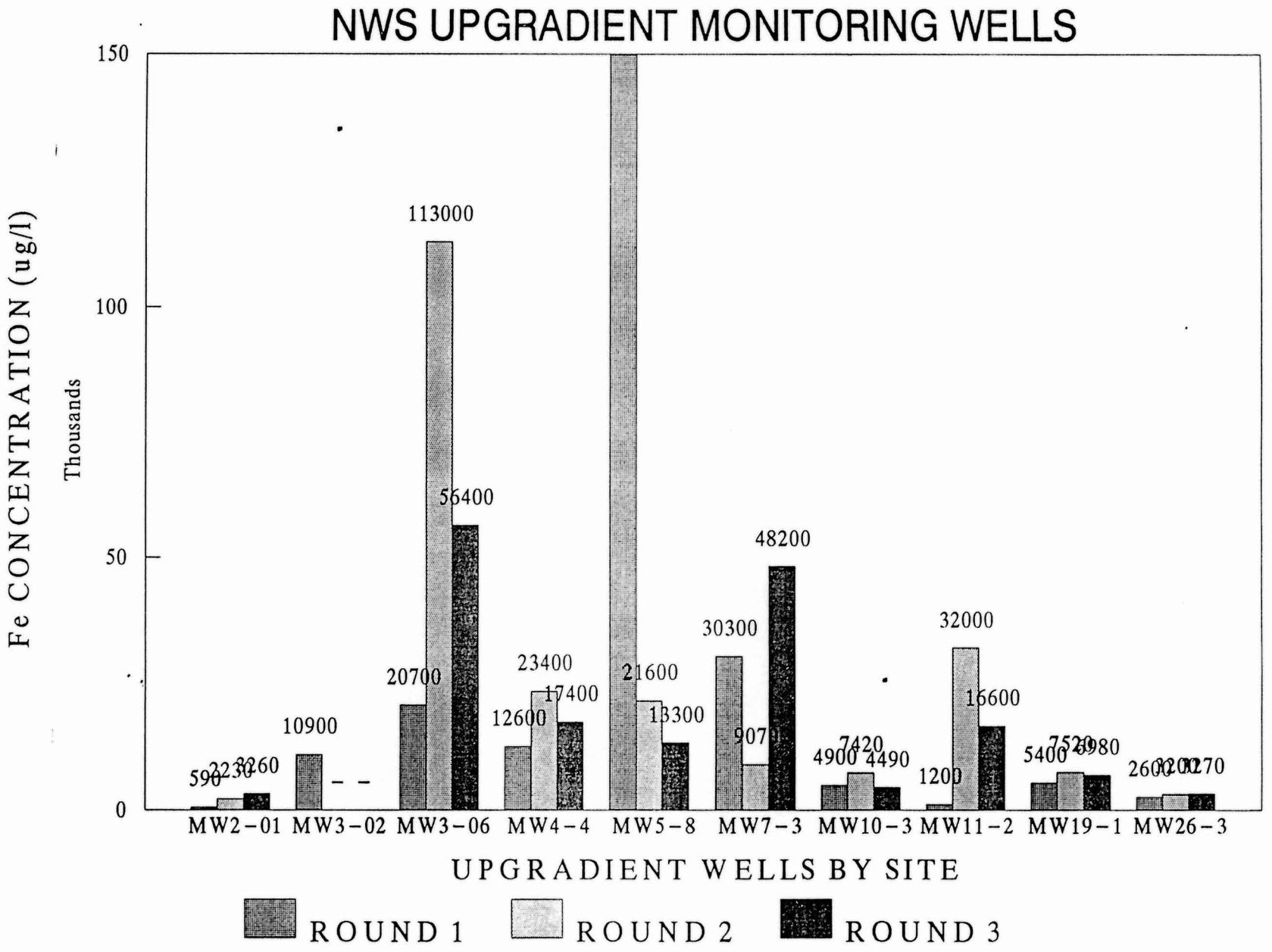
Table 5-6

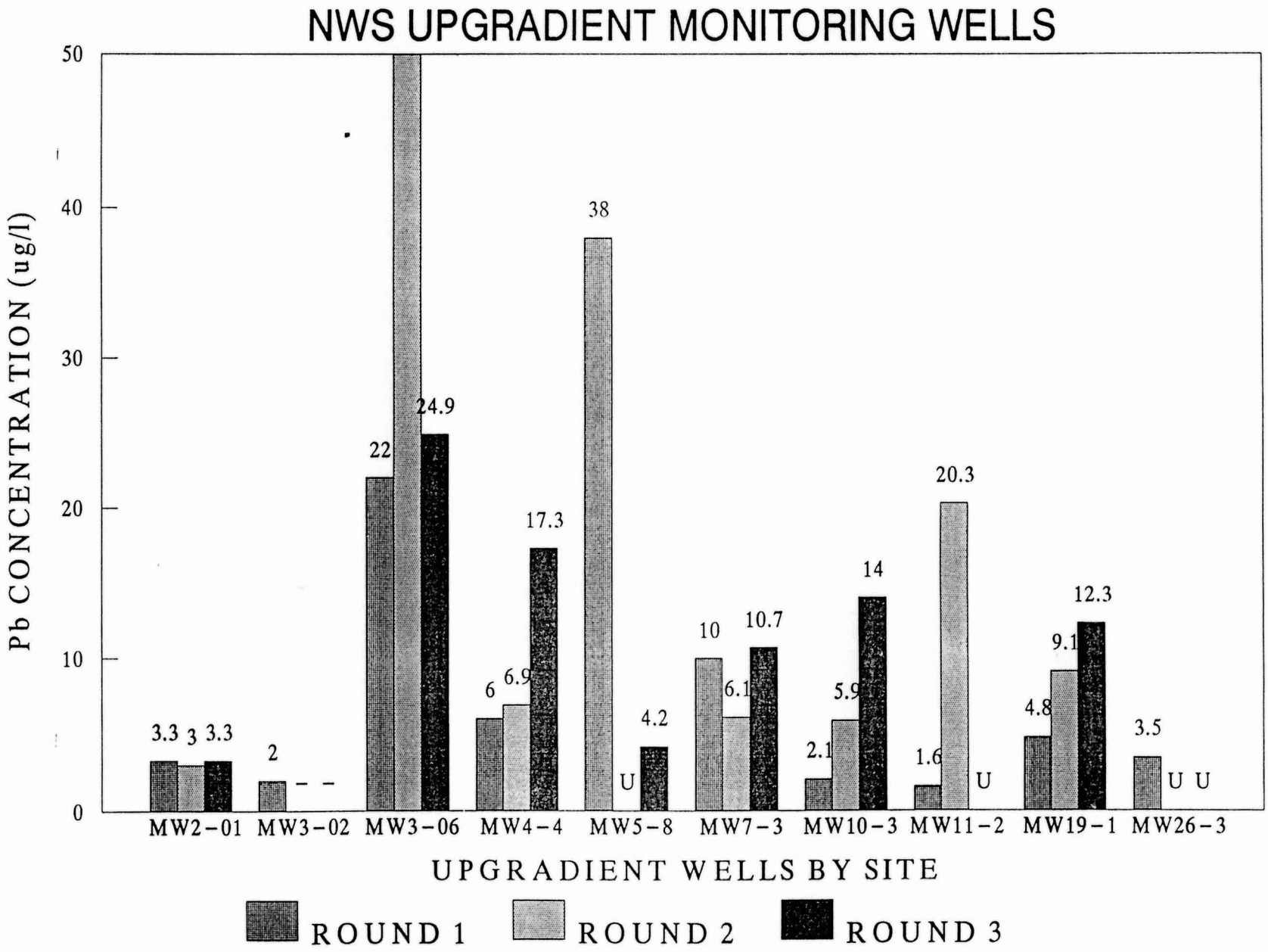
Concentrations in Downgradient Monitoring Wells

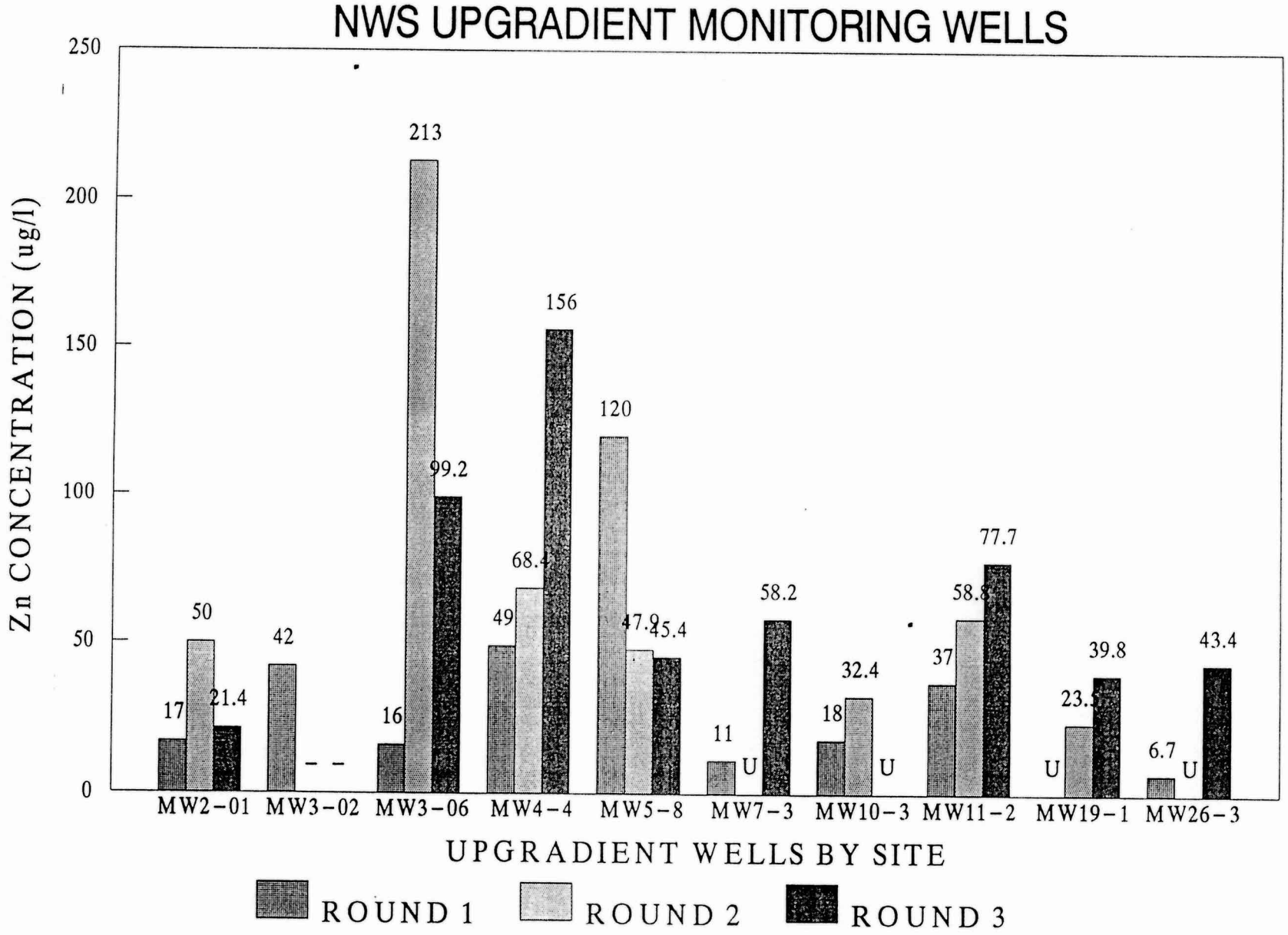
National Drinking Water Standards	Primary 100 µg/L Cr	MCL 50 µg/L Pb	Secondary 5,000 µg/L Zn
Site 2	02[a] (2)[b] 04 (2) 05 (1, 2) 06 (1, 2) 07 (1, 2, 3)	 (2, 3)	<5,000 µg/L
Site 3	01 (2) 05 (2, 3) 06 (2, 3) 07 (2)	(2) (2, 3) (2) (2)	<5,000 µg/L
Site 4	<100 µg/L	<50 µg/L	<5,000 µg/L
Site 5	08 (1, 2, 3) 01 (1, 2) 02 (1, 2) 04 (2, 3) 05 (1, 2, 3) 06 (1, 2, 3) 07 (1, 2, 3)	 (2, 3) (3)	<5,000 µg/L
Site 7	7-1 (3) 7-4 (2, 3) 7-5 (2, 3)	7-1 (3) 7-4 (2, 3) 7-5 (2, 3)	<5,000 µg/L
Site 10	10-4 (1, 2, 3) 10-1 (2, 3) 10-5 (1, 2, 3) 10-7 (1)	10-4 (3) 10-5 (1, 2, 3) 10-7 (1)	<5,000 µg/L
Site 11	11-2 (2, 3) 11-1 (3) 11-3 (3)	11-1 (3)	<5,000 µg/L
Site 19	19-4 (1) 19-5 (2, 3) 19-2 (1, 2, 3) 19-3 (2) 19-6 (1, 2, 3)	19-5 (2) 19-6 (1, 2, 3)	<5,000 µg/L
Site 26	26-4 (2)	<50 µg/L	<5,000 µg/L

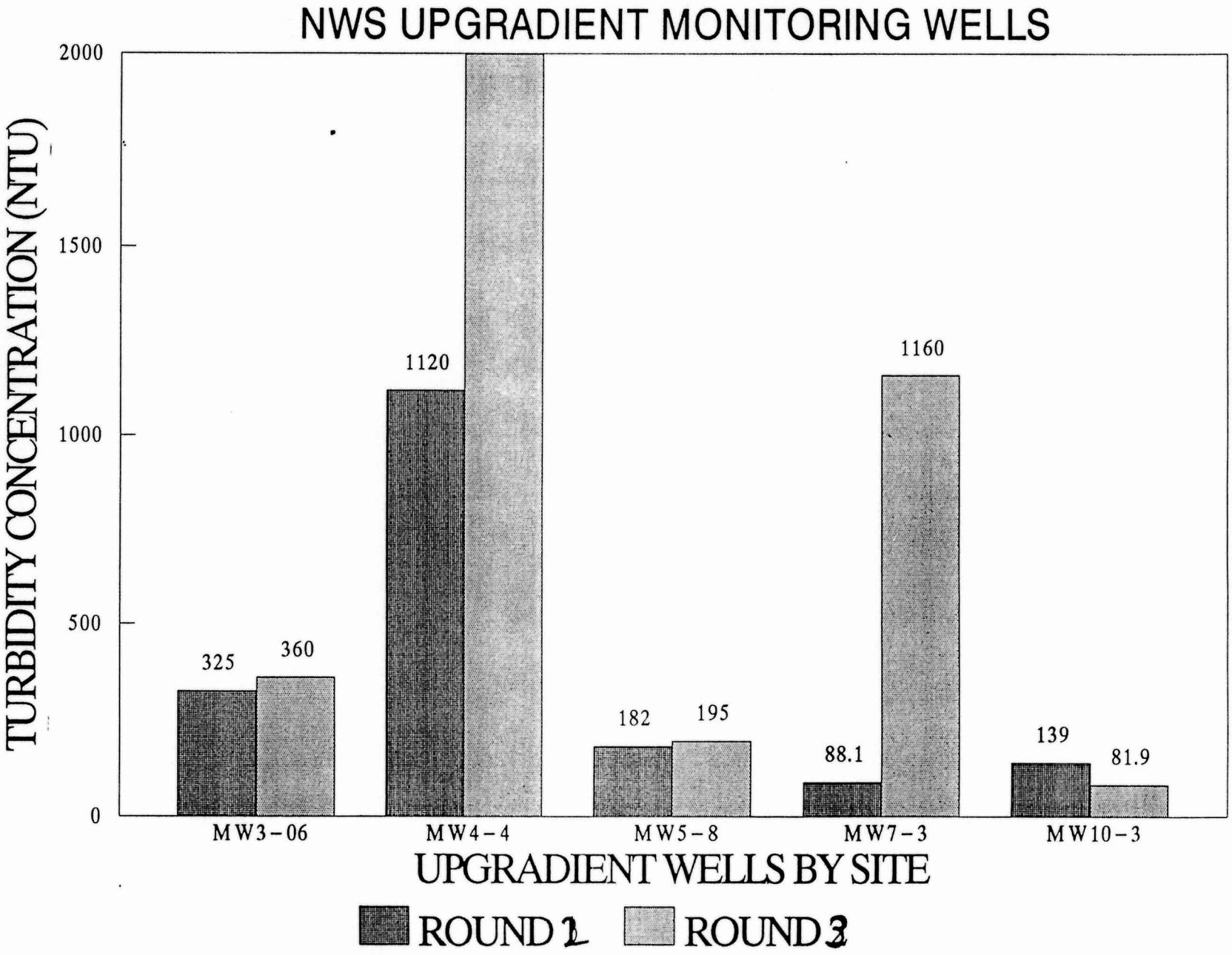
Note: a - Denotes monitoring well ID.
b - Denotes sampling round.


NWS UPGRADIENT MONITORING WELLS
Cr CONCENTRATION (ug/l)
250
200
150
100
50
0
8.1
23.4
15.4
U - -
41
209
114
U
15.9
24.3
155
104
30
U
30.1
23
68.1
21.3
U
213
108
47
61
44.6
U U U
MW2-01
MW3-02
MW3-06
MW4-4
MW5-8
MW7-3
MW10-3
MW11-2
MW19-1
MW26-3
UPGRADIENT WELLS BY SITE
ROUND 1
ROUND 2
ROUND 3


NWS UPGRADIENT MONITORING WELLS
Fe CONCENTRATION (ug/l)
Thousands
150
100
50
0
590
2230
3260
10900
20700
113000
56400
12600
23400
17400
21600
13300
30300
907
48200
4900
7420
4490
1200
32000
16600
5400
7520
6980
MW2-01
MW3-02
MW3-06
MW4-4
MW5-8
MW7-3
MW10-3
MW11-2
MW19-1
MW26-3
UPGRADIENT WELLS BY SITE
ROUND 1
ROUND 2
ROUND 3


NWS UPGRADIENT MONITORING WELLS
Pb CONCENTRATION (ug/l)
50
40
30
20
10
0
3.3 3 3.3
2
- -
22
24.9
6
6.9
17.3
38
U
4.2
10
6.1
10.7
2.1
5.9
14
1.6
20.3
U
4.8
9.1
12.3
3.5
U U
MW2-01
MW3-02
MW3-06
MW4-4
MW5-8
MW7-3
MW10-3
MW11-2
MW19-1
MW26-3
UPGRADIENT WELLS BY SITE
ROUND 1
ROUND 2
ROUND 3


NWS UPGRADIENT MONITORING WELLS
Zn CONCENTRATION (ug/l)
250
200
150
100
50
0
17
50
21.4
42
– –
16
213
99.2
49
68.4
156
120
47.9
45.4
11
U
58.2
18
32.4
U
37
58.8
77.7
U
23.5
39.8
6.7
U
43.4
MW2-01
MW3-02
MW3-06
MW4-4
MW5-8
MW7-3
MW10-3
MW11-2
MW19-1
MW26-3
UPGRADIENT WELLS BY SITE
ROUND 1
ROUND 2
ROUND 3


NWS UPGRADIENT MONITORING WELLS
TURBIDITY CONCENTRATION (NTU)
2000
1500
1000
500
0
325
360
1120
182
195
88.1
1160
139
81.9
MW3-06
MW4-4
MW5-8
MW7-3
MW10-3
UPGRADIENT WELLS BY SITE
ROUND 1
ROUND 2

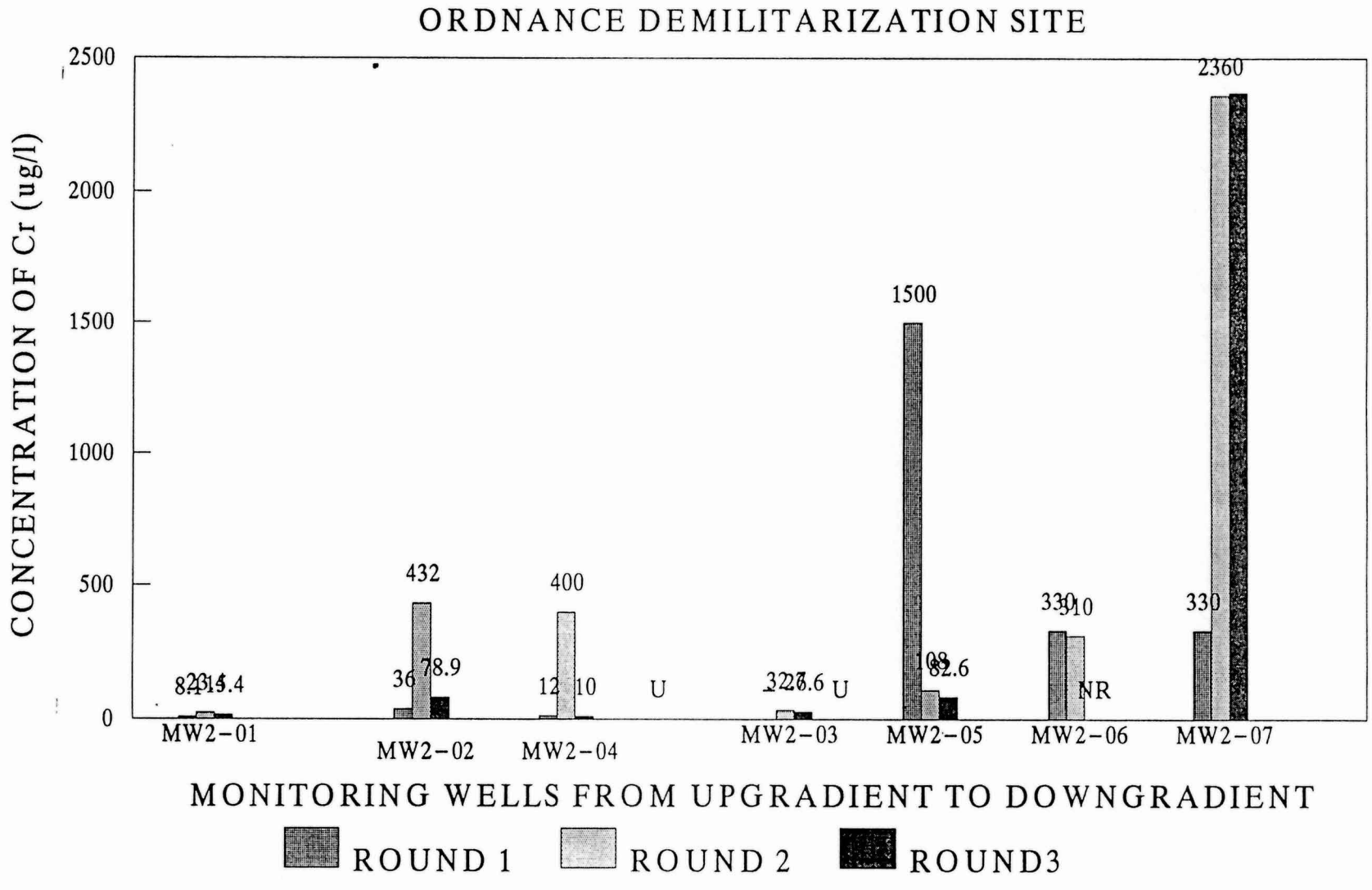
NWS Earle, Site 2 (ODS)

Compounds	Upgradient Well	Crossgradient		Downgradient			
(ug/L)	MW2-01	MW2-02	MW2-04	MW2-03	MW2-05	MW2-06	MW2-07
Round 1: March, 1991							
Cadmium	- U	- U	- U	- U	- U	- U	4.5
Chromium	8.1	36	12	- U	1500	330	330
Iron	590	5300	1300	8.8	202000	42000	51300
Lead	3.3	1.4	2	6.8	28	15	21
Zinc	17	78	15	- U	190	67	91
Round 2: October, 1991							
Cadmium	5 U	5 U	5 U	5 U	5 U	5 U	5
Chromium	23.4	432	400	32.7	108	310	2360
Iron	2230	52600	62200	4860	1480	42000	?
Lead	3 U	7	6.2	3 U	3	6.7	190
Zinc	50	91.3	82.8	52.5	29.6	74.2	817
Round 3: November, 1991							
Cadmium	-	-	-	-	-	-	-
Chromium	15.4	78.9	10 U	26.6	82.6	NR	2370
Iron	3260	9770	350	3670	111000	NR	300000
Lead	3.3	3 U	5.9	3 U	3 U	NR	130
Zinc	21.4	85	41.6	44.5	49.5	NR	657

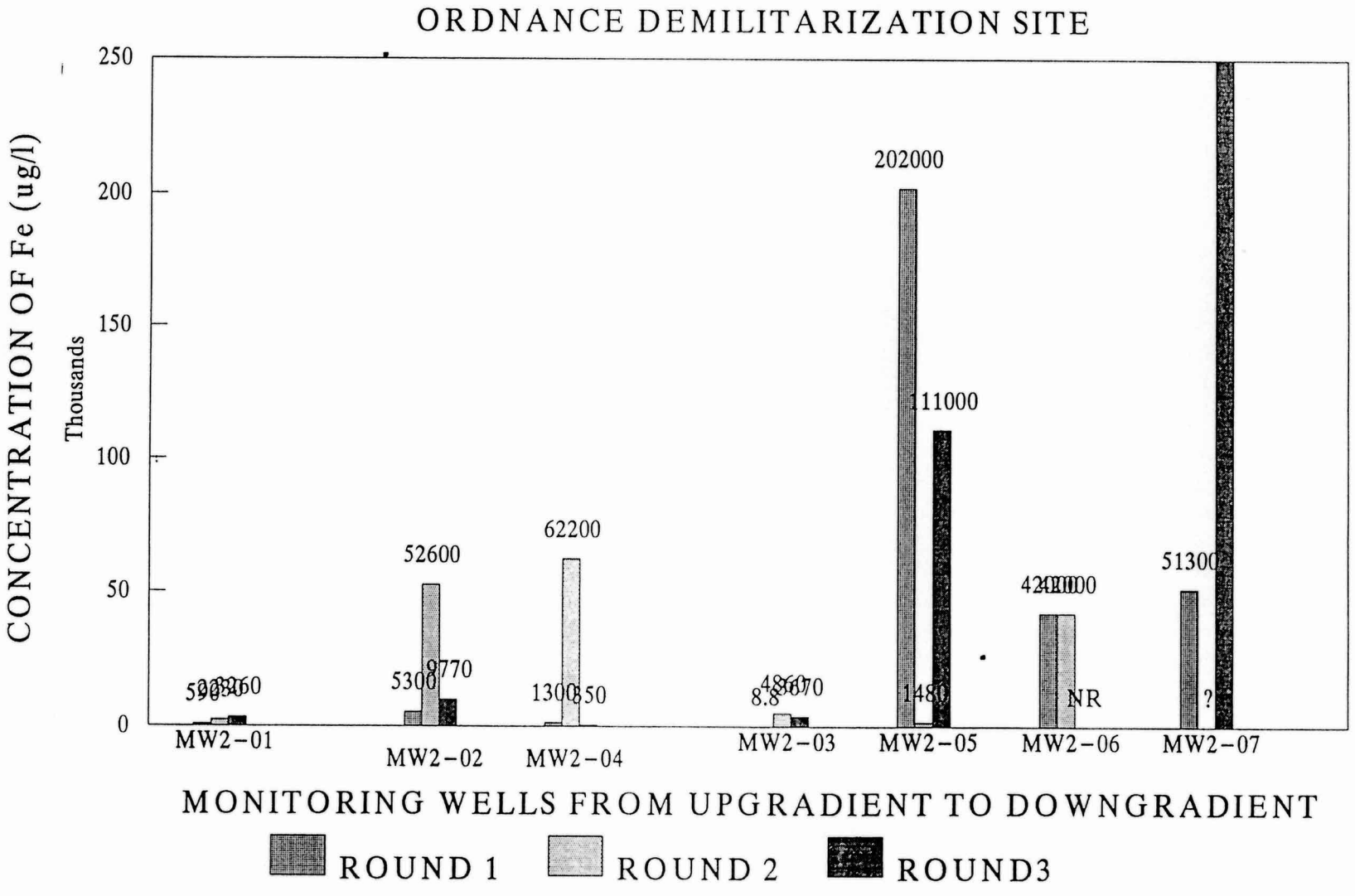
Legend: U = Not detected

NR = Not requested

SITE 2

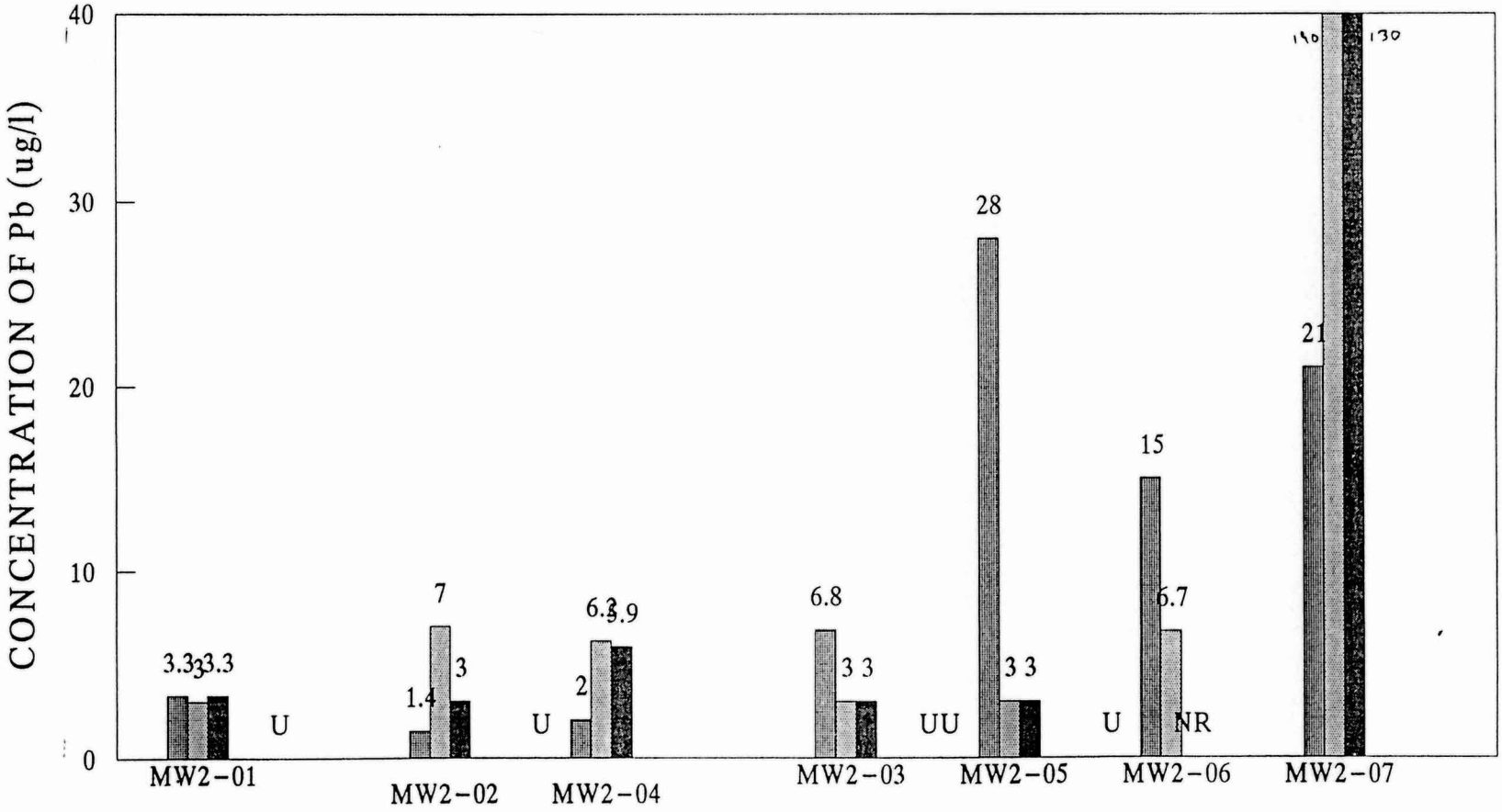

ORDNANCE DEMILITARIZATION SITE
CONCENTRATION OF Cr (ug/l)
2500
2000
1500
1000
500
0
2360
1500
432
400
330
330
78.9
82.6
U
U
NR
MW2-01
MW2-02
MW2-04
MW2-03
MW2-05
MW2-06
MW2-07
MONITORING WELLS FROM UPGRADIENT TO DOWNGRADIENT
ROUND 1
ROUND 2
ROUND3

SITE 2

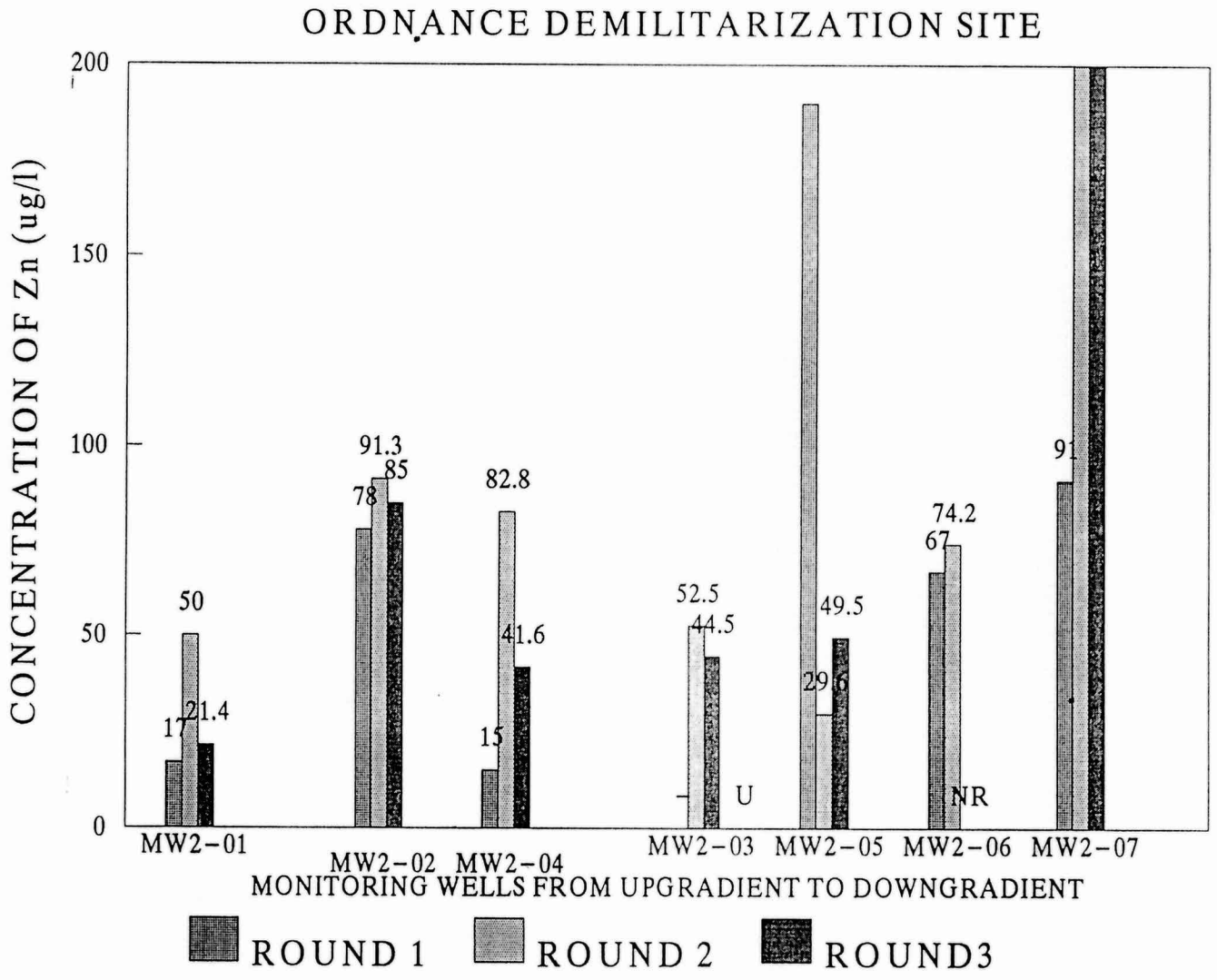

ORDNANCE DEMILITARIZATION SITE
CONCENTRATION OF Fe (ug/l)
Thousands
250
200
150
100
50
0
202000
111000
62200
52600
51300
5300
9770
1300
8.8
1480
NR
?
MW2-01
MW2-02
MW2-04
MW2-03
MW2-05
MW2-06
MW2-07
MONITORING WELLS FROM UPGRADIENT TO DOWNGRADIENT
ROUND 1
ROUND 2
ROUND3

SITE 2

. ORDNANCE DEMILITARIZATION SITE



SITE 2


ORDNANCE DEMILITARIZATION SITE
CONCENTRATION OF Zn (ug/l)
200
150
100
50
0
17
50
21.4
78
91.3
85
15
82.8
41.6
52.5
44.5
U
29.6
49.5
67
74.2
NR
91
MW2-01
MW2-02
MW2-04
MW2-03
MW2-05
MW2-06
MW2-07
MONITORING WELLS FROM UPGRADIENT TO DOWNGRADIENT
ROUND 1
ROUND 2
ROUND3

NWS Earle, SITE 3

Compounds (ug/L)	Upgradient		Crossgradient		Downgradient Wells		
	MW3-02	MW3-06	MW3-03	MW3-05	MW3-01	MW3-04	MW3-07
Round 1: March, 1991							
Cadmium	- U	- U	U	21	44	- U	- U
Chromium	- U	41	U	60	82	- U	18
Iron	10900	20700	810	41300	244000	170000	9200
Lead	2	22	U	30	35	11	6.8
Zinc	420	16	42	320	87	260	15
Round 2: October, 1991							
Cadmium	-	5 U	-	30	49.2	-	19
Chromium	-	209	-	338	641	-	227
Iron	-	113000	-	369000	1240000	-	111000
Lead	-	51.3	-	114	147	-	59.7
Zinc	-	213	-	835	400 U	-	288
Round 3: November, 1991							
Cadmium	-	5 U	-	34.7	23.5	-	33.6
Chromium	-	114	-	157	245	-	86.1
Iron	-	56400	-	524000	355000	-	19000
Lead	-	24.9	-	157	4.5	-	42.5
Zinc	-	99.2	-	699	314	-	592

Legend: U = Not detected

NR = Not requested